Mapping Patient Data to Consider the Role of Geography in Public Health

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Outline

• Geography: does it matter, and who cares?
• Mapping data: what to consider, challenges
• Mapping styles: choropleth, interpolation, ring
Why do want to make maps of health?

- Desire to understand how health varies by area
  - “Poorest in England 'live seven years less on average’” (BBC, 11/02/11)
- Belief that place may influence health above and beyond individual-level characteristics
  - ‘Glasgow effect’
- Marmot’s report on the social determinants of health
  - Obesogenic environments
Differences in Life Expectancy within a small area in London

Travelling east from Westminster, each tube stop represents nearly one year of life expectancy lost

Male Life Expectancy
77.7 (CI 75.6-79.7)

Female Life Expectancy
84.2 (CI 81.7-86.6)

Electoral wards just a few miles apart geographically have life expectancy spans varying by years. For instance, there are eight stops between Westminster and Canning Town on the Jubilee Line – so as one travels east, each stop, on average, marks nearly a year of shortened lifespan.  

1 Source: Analysis by London Health Observatory using Office for National Statistics data. Diagram produced by Department of Health
Geography and health inequalities

Group warns of area alcohol problem

Twice as many young people living in the North East of England receive treatment for alcohol problems compared with the rest of the country, a study has found.

Figures from health campaign group Balance show 118 of every 100,000 under 18s in the North East were treated for drink problems - double the national average.

More than 600 of the 9,450 people receiving specialist alcohol treatment in the region in 2010/11 were under the age of 18, Balance said.

The North East-based group is now calling for a review of alcohol advertising to help tackle "harmful and hazardous" levels of drinking among young people.

Balance director Colin Sheolian said: "Our region is drinking too much from an early age driven by alcohol which is too affordable, too available and too heavily promoted. Although the Government's alcohol strategy aims to turn the tide against binge drinking, it is weak on a clear strategy around the marketing and promotion of alcohol. Our concern is that it will remain effectively self-regulatory. This is why we need to call on Government for change."

Leeds: Health statistics show it’s a tale of two cities

‘People in the most deprived parts of the city can expect to live for up to 12 YEARS less than those from well-off suburbs.’
Example of public interest in maps, regular feature on Guardian website
Data provided here by NHS Information Centre
Similar websites in London: Health Needs Assessment Toolkit; London Health Observatory
Health Needs Assessment Toolkit

Model Based Estimate for Binge Drinking

Local authority: Camden  Period: 2003 - 2005

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Life expectancy at birth >> LE Female >> 2008-10

Click here to select indicator
Go to website for Harms Indicator
Go to double map
Notes/Charts
Help

Upper Tier Local Authorities
- 74.1 - 81.1
- 81.1 - 82.0
- 82.1 - 82.9
- 83.0 - 83.6
- 83.7 - 89.0

Name | Indicator
--- | ---
Camden | 81.6
Central Bedfordshire | 82.3
Cheshire East | 81.9
Cheshire West and Chester | 82.3
Cornwall | 80.1
County Durham | 81.2
Croydon | 82.3
Cumbria | 81.6
Darlington | 81.5
Derby | 81.9
Derbyshire | 82.6
Dover | 83.8
Doncaster | 80.1
Dorset | 84.1
Dudley | 85.5
East Riding of Yorkshire | 82.9

Name | Indicator
--- | ---
East Midlands | 82.4
East of England | 83.2
England | 82.6
London | 83.3
North East | 81.2
North West | 82.1
South East | 83.5
South West | 82.5
West Midlands | 82.2
Yorkshire and Humber | 82.8
Challenges with mapping data (how to lie with maps)

- Modifiable Areal Unit Problem (MAUP)
- Colour scheme
- Data ranges
- Geographic size
- Denominators: practice or resident population?
MAUP: example

- MAUP is a challenge in choropleth maps, due to boundary options.
- Often can be assessed via geographic sensitivity analysis.
- Leeds example.
Using patient data

- With Google maps, easy to find someone from address, postcode
- **Privacy risk breach = Granularity (Nature) of the data x The Trustworthiness of the Individual**
- Usually Lower Super Output Area (LSOA), mean population of 1500
Point data considerations

- Issues with confidentiality
- Must aggregate to minimum number to avoid re-identification (‘inference attack’)
- Other options for point data
Choropleth Maps: defined boundaries

Diabetes SIR (Optimal model)
- 75.5 - 92.8
- 92.9 - 100.0
- 100.1 - 150.0
- 150.1 - 250.0
- 250.1 - 350.1
Map shows ill health persists in same area for 114 years

Researchers aiming to improve the health of east Londoners have found poverty and ill health have persisted there for more than 100 years.

Experts from Queen Mary, University of London, mapped those they thought were most at risk of type 2 diabetes.

They said it was "startling" how similar the results were to Victorian reformist Charles Booth's poverty maps.

Type 2 diabetes is strongly linked with poverty and South Asian ethnicity, both of which are common in east London.
Mapping in relation to GP practices

- 2011 Diabetes Risk in East London
- Risk in GP registered population of Type 2 diabetes in 10 years using QDrisk (n=157,045)
- Tower Hamlets GPs on EMIS (34/36)
Mapping numbers

• Problems may arise in areas with small numbers (<10)
• However, can be of interest to strategists, analysts rather than for academic publication
Interpolation as an alternative display option

• Spatial interpolation may be used as an alternative to choropleth maps
• If data are moderately spatially autocorrelated, kriging is a valid method to estimate unsampled data
• Alternative option is inverse distance weighted (IDW)
Interpolation as a tool for geovisualisation

• Follows Tobler’s first law of geography
  • “All things are related, but those which are near to each other are more related than distant things” (1970)
• Diabetes risk scores
• Smoothed from population centres, median value
East London’s ‘Diabetes belt?’

Percentage at high risk by general practice

- High: 16.7
- Low: 4.1

- General Practices:
GP ratings in England

NHS Choices ratings per 1,000 registered patients

- 0 - 0.06
- 0.06 - 0.09
- 0.09 - 0.14
- 0.14 - 0.26
- 0.26 - 0.48
- 0.48 - 0.93
- 0.93 - 1.81
- 1.81 - 3.53
- 3.53 - 8.95
- 8.95 - 13.88

Kilometers
Dorling cartograms

Obesity prevalence in the US. Source: http://hci.stanford.edu/jheer/files/zoo/
Summary

- Choropleth maps are great for basic questions, quick display
- Interpolated maps dissolve administrative boundaries, better for small-scale representation
- Ring maps can provide a dashboard of data
- Graduated symbols can be useful for large-scale maps of cities, proportions
- Dorling cartograms provide more complex but interesting, data display
- What do maps add to analysis, research?
Thank you!